AN INFLATABLE PIPE TEST PROBE

FIELD OF THE INVENTION

THIS INVENTION relates to an inflatable pipe test probe suitable for hydrostatic testing of pipes for leaks and simultaneous interior examination of the pipe using a camera.

SUMMARY OF THE INVENTION

In one broad aspect the present invention comprises a flexible probe for sealing a pipe or applying a patch, the probe comprising an inflatable bladder and camera assembled in series at a distal end of a cable and hose, the cable and hose being used to feed the probe down a pipe in a feed direction and retract the probe in the opposite direction, the inflatable bladder comprising an elongate annular bladder surrounding the cable with the camera at the head, the camera providing an advance view in the feed direction, the probe being flexible and able to pass down a pipe and deform to pass around corners in the pipe while carrying a tubular patch and upon inflation seal or patch the pipe. The inflatable bladder preferably comprises a cylindrical elastic bladder sealed airtight at opposite ends and being biassed to expand medially. The inflatable bladder preferably has spaced sealing ribs distributed along its length. Different bladders are designed to suit different pipe sizes and to increase the life of the bladder is in use inflated to a predetermined pressure and size at that pressure. Thus it is preferable that a bladder is designed to suit a particular pipe size and in use is inflated to a predetermined pressure and size at that pressure so that its operation within the pipe is predictable and to specification.

In a preferred aspect the present invention resides in a pipe test probe comprising an inflatable seal and camera assembled in series at a distal end of a cable and hose used to feed the probe down a pipe in a feed direction and retract the probe in the opposite direction, the inflatable seal comprising an elongate annular bladder surrounding the cable with the camera at the head and providing an advance view in the feed direction, the probe being flexible and able to pass down a pipe and deform to pass around corners in the pipe and upon inflation to seal the pipe for static test purposes.

Typically the inflatable seal comprises a cylindrical elastic bladder sealed airtight at opposite ends and being biassed to expand medially by reason of medially thinned wall section or sections. Preferably the wall has protruding sealing ribs distributed along its length. The sealing ribs are preferably evenly spaced.

Preferably the bladder is designed to suit different pipe sizes and to increase the life of the bladder is in use inflated to a predetermined pressure and size at that pressure. In one form suited to a 100 mm pipe, the bladder has a 40 mm outside diameter in its relaxed state and is inflatable to 114 mm at a maximum pressure of between 10 psi to 15 psi. In the case of 150 mm pipe, the outside diameter would be 60 mm typically and 164 mm outside diameter when inflated to the 10 psi to 15 psi pressure. Any suitable elastic material may be used, particularly those materials suitable to repeated inflation and deflation in a hydrostatic pipe testing environment.

In another aspect there is provided a probe for remote patching of damaged pipes, the probe comprising an inflatable patch applicator and camera assembled

in series at a distal end of a cable and hose used to feed the probe down a pipe in a feed direction and retract the probe in the opposite direction, the inflatable patch applicator comprising an elongate annular bladder surrounding the cable with the camera at the head, the camera providing an advance view in the feed direction, a tubular open ended adhesive patch surrounding the bladder and upon inflation of the bladder in situ to a predetermined pressure the bladder applies the patch and bulges out the open ends of the patch to dress the ends of the patch.

In another aspect there is provided a system for in situ remote patching of pipes, the system comprising an adhesive applicator jig for onsite application of adhesive to a tubular patch mounted on a flexible inflatable patch applicator probe located at the distal end of a flexible feed cable , the jig comprising a hollow former sandwiched between the probe and patch to stabilise same while the adhesive is being applied and then being slidably removable before the patch and probe are fed into a pipe.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the present invention may be more readily understood and put into practical effect, reference will now be made to the accompanying drawings which illustrate one preferred embodiment of the invention as suited to 100 mm pipe testing.

Figure 1 is a schematic drawing illustrating the probe being used;

Figure 2 is a part cut away view illustrating the probe in position in a pipe prior to inflation; and

Figure 3 is a drawing illustrating the probe in position, inflated and sealing the pipe.

Figure 4 is a drawing illustrating a jig for loading a probe with a resin saturated patch;

Figures and 5 and 6 demonstrate the process by which the patch is loaded onto an inflatable probe; and

Figures 7 to 10 illustrate the use of the probe to apply the patch, the broken pipe break having being located either using the video camera or using the static test procedure.

METHOD OF PERFORMANCE

Referring to the drawings and initially to Figure 1, there is illustrated a test probe 10 according to the invention where an operator 11 manually feeds the probe 10 along a pipe 12 by reason of an air tube 13 and CCTV cable 14. The operator may view the output from camera head 15 on the probe 10 via video monitor 16. As can be seen in Figure 1, the probe 10 has a elongate flexible body 16 so that it may deform to pass around corners in the pipe 12 as typically illustrated at 17. This construction of the probe will be described in greater detail in relation to the drawings.

In order to test the pipe 12, the probe 10 is positioned at a desired position in the pipe 12 and inflated to perform a static test by back filling the pipe 12 from the probe and progressively testing for leakage by stepwise inflation and deflation of the probe 10 as it is withdrawn using normal hydrostatic test procedures.

Referring now to Figures 2 and 3, the probe 10 is illustrated in greater detail and like numerals have been used to illustrate like features. The probe 10 comprises the camera head 15 and elongate body 16 which comprises in this case an elastic bladder 18 designed for testing 100mm pipe. The size will vary for different pipe sizes. The bladder 18 has thickened marginal edge portions 19 and 20 at opposite ends so that when inflated it preferentially expands medially as shown in Figure 3. At opposite ends of the bladder, stainless steel rigid couplings 21 and 22 rigidly secure the fittings for the camera head 15 and the cable 14 and air tube 13 to the bladder 18 by clamping rings 22 and 23 respectively. The bladder has sealing ridges 24 distributed evenly along its length.

In the illustrated embodiment the bladder 18 has an uninflated outside diameter of 40 mm and may be expanded to a designed external diameter of 114 mm at 10psi to 15 psi inflation pressure. This would effectively seal the 100 mm pipe in use.

Once a break has been located, a probe of the present type may be utilised to apply a patch to the break. referring to Figures 5 to 10 this aspect will be described. A resin saturated cylindrical patch is applied to the interior of a pipe using the expandable bladder to force the patch onto the interior wall of the pipe to affect the patch. The present illustrated embodiment a probe 550mm long is utilised, the camera being used to view the break and then the probe being moved an additional 350mm from the head of the camera to centre the patch on the break.

Figures 4, 5 and 6 illustrate a process whereby resin may be applied to the patch. The patch may be of any suitable type utilised and commonly applied to the

lining pipes cut to appropriate length and the resin being applied on site, any suitable resin for plumbing applications may be used, typically two part apoxy/polyamines suited to a plumbing environment may be utilised and for under water application. It is preferable that it be low viscosity and there be a relatively short curing time, typically touch dry in two hours at 25°C and hard at 12 hours at 25°C. The base is typically an epoxy resin liquid polymer base at 40 - 70%, the cure being Aminated Oligomer 20-50%. A suitable product is available from NMP, Unit 19 10 Miltiadis St, Acacia Ridge, Qld Australia (www.nmp-pty.com.au). As can be seem from Figure 4 the jig 25 includes a drum section 26, a hanger 27, a clamp 28, a former tube 29 and a release pin 30. The release pin 30 enables the former tube 29 to drop into the drum, the former tube 29 is sized to enable a probe 31 to be positioned in the former tube with the patch material fastened to the probe by a rubber band 33 positioned just above the upper edge of the former tube 29 as illustrated in Figure 5. The resin mix is applied to the patch material while it is on the former to saturate the patch and after the former is dropped into the drum 26 the rubber bands 34 and 35 are positioned as illustrated in Figure 6. It will be appreciated that the patch tube material 32 includes an internal polyurethane lining so that the resin does not come into contact with the probe. A suitable patch material is Brawoliner available from RS TECHNIK AG werkstrasse 9 CH 8627 Gruningen (www.rstechnik.com) As a matter of process a release agent of any suitable type may be sprayed onto the probe before the resin is applied. Once the resin mix is applied and just prior to entry into the pipe to be repaired each of the rubber bands 33, 34, and 35 are cut part way through so that the rubber bands will

break as the probe expands to force the patch material into engagement with the pipe.

Figures 7, 8, 9 and 10 illustrate the application of the patch, the breaking of the rubber bands and the removal of the probe with the patch in place.

In the present case, the probe length is selected to suit the pipe size and length of break. The probe expands the same way as the test probe but the applied pressure and the configuration is different. The probe is medially thin so that it expands centrally and in the illustrated embodiment, the applicant drives the probe to 20psi and this has the effect of initially driving the patch in its medial region into contact with the pipe and then as the probe further expands it will fill the entire pipe and will bulge at each end as illustrated in Figure 9. this annular bulging is to dress the edge of the patch to provide a small taper by reason of the probe bulging in the longitudinal direction beyond the opposite ends of the patch.

Whilst the above has been given by way of illustrative example of the present invention, many variations and modifications thereto will be apparent to those skilled in the art without departing from the broad ambit and scope of the invention as herein set out in the appended claims.